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Published in:
Archives of Gerontology and Geriatrics

DOI:
10.1016/j.archger.2014.09.009

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PII: S0167-4943(14)00160-5
DOI: http://dx.doi.org/doi:10.1016/j.archger.2014.09.009
Reference: AGG 3062

To appear in: *Archives of Gerontology and Geriatrics*

Received date: 13-11-2013
Revised date: 25-6-2014
Accepted date: 16-9-2014

Please cite this article as: Haines, T.P., Williams, Ce.M., Hill, A.-M., McPhail, Sn.M., Hill, D., Brauer, Sy.G., Hoffmann, Ty.C., Etherton-Beer, C.,Depressive Symptoms and Adverse Outcomes from Hospitalization in Older Adults: Secondary Outcomes of a Trial of Falls Prevention Education., *Archives of Gerontology and Geriatrics* (2014), http://dx.doi.org/10.1016/j.archger.2014.09.009

Depressive Symptoms and Adverse Outcomes from Hospitalization in Older Adults: Secondary Outcomes of a Trial of Falls Prevention Education.

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Keywords: depression, elderly, hospital, falls

Key points:

1. Depressive symptoms are common amongst older hospital inpatients and

generally persist through to discharge.

2. Depressive symptoms are associated with longer length of stay and falls while in hospital
3. Depressive symptoms worsen if exposed to low intensity (video, workbook) falls prevention education material.

Word count: 3236

Depressive Symptoms and Adverse Outcomes from Hospitalization in Older Adults: Secondary Outcomes of a Trial of Falls Prevention Education.

Abstract

Depression is common in older people and symptoms of depression are known to substantially increase during hospitalisation. There is little known about predictors of depressive symptoms in older adults or impact of common interventions during hospitalisation. This study aimed to describe the magnitude of depressive symptoms, shift of depressive symptoms and the impact of the symptoms of depression amongst older hospital patients during hospital admission and identify whether exposure to falls prevention education affected symptoms of depression.

Participants (n=1206) were older adults admitted within two Australian hospitals, the majority of participants completed the Geriatric Depression Scale (GDS) short form at admission (n=1168). Participants' mean age was 74.7 (±SD 11) years and 47%(n=551) were male.

At admission 53% (619 out of 1168) of participants had symptoms of clinical depression and symptoms remained at the same level at discharge for 55% (543 out of 987). Those exposed to the low intensity education program had higher GDS scores at discharge than those in the control group (low intensity vs control n=652, adjusted regression coefficient (95% CI) = 0.24 (0.02, 0.45), p=0.03). The only factor other than admission level of depression that affected depressive symptoms change was if the participant was worried about falling.

Older patients frequently present with symptoms of clinical depression on admission to hospital. Future research should consider these factors, whether these are modifiable and whether treatment may influence outcomes.

Introduction:

Depression is common amongst older people,(Bryant, Jackson, & Ames, 2009; Djernes, 2006; Solhaug, Romuld, Romild, & Stordal, 2012) and it is well understood that the risk of experiencing symptoms of depression is increased by cognitive impairment, illness and limited access to friends and family support networks.(Djernes, 2006; Sheikh & Yesavage, 1986) It is not surprising then that symptoms of depression have been shown to increase in frequency and severity during times of hospitalisation.(Givens, Jones, & Inouye, 2009) Recent research has found that over two thirds of older people undertaking inpatient rehabilitation had some form of clinically significant psychiatric comorbidity upon admission and over one third displayed significant symptoms of depression at discharge.(Gluyas, Lum, Chong, Borg, & Haines, 2011)

Clinicians currently have little guidance to identify patients at high risk of developing depressive symptoms or having worsening symptoms during their hospital admission. This is important as early identification may permit delivery of services to prevent development or worsening of depressive symptoms. Another issue of importance to clinicians is whether health interventions designed to address other geriatric issues (such as falls prevention) may have the unintended consequence of worsening depressive symptoms. Previous research has demonstrated that older adults rarely discuss falls with their health professionals (Lee, McDermott, Hoffmann, O'Connell, & Haines, In Press) and that some find this discussion very confronting, as they commonly associate falls with being old and frail. (Yardley et al., 2008) It was these challenges and observations within the clinical environment that lead to the formulation of the study questions.

This study is a secondary analysis of data collected as a part of a randomised trial investigating the efficacy of two patient education strategies for the prevention of falls amongst older hospital inpatients. The analyses presented in this paper aim to i) describe the magnitude symptoms of depression amongst older hospital patients, ii) describe how symptoms of depression change during hospital admission, iii) identify factors associated with worsening symptoms of clinical depression, iv) describe the impact that symptoms of depression had on length of stay in hospital, falls, and the probability of being discharged to a residential aged care facility, and v) determine whether provision of either of two patient education programs for the prevention of falls had an impact on change in depressive symptoms during hospital admission.

Method:

Study Design

This study was a 3-group randomized trial. There were two active intervention groups: a *"low intensity"* education program that involved providing a video and written materials discussing the prevention of falls, and a *"high intensity"* education program where the same video and written materials were provided along with face-to-face education with a health professional. The control group received usual care alone.(Haines et al., 2011; A.M. Hill, Hill, et al., 2009; A.M. Hill, McPhail, et al., 2009) The secondary analysis, utilized observational data collected from participants within the RCT to address the research questions.

Participants and setting

Participants were older adults admitted to acute (orthopedic and acute-respiratory

medicine) and subacute (geriatric assessment and rehabilitation) wards of the Princess Alexandra Hospital, Brisbane, Australia, and the acute (medical-surgical) and subacute (restorative–stroke rehabilitation) wards of Swan Districts Hospital, Perth, Australia. Patients were enrolled until they were discharged, transferred to a non-study ward, or died. Patients were excluded if they had previously participated in the patient education program or were too ill to provide informed consent as determined by hospital staff. A sample size of 1206 was recruited out of a possible 5162 admissions across all study wards.

Measurements:

Symptoms of depression were measured using the Geriatric Depression Scale – Short Form (GDS).(Sheikh & Yesavage, 1986) This was administered at admission and discharge by a research assistant blinded to group allocation. The GDS scale was specifically developed for detecting depression in older adults and consists of 15 items. A cut-off score of six or above out of the maximum 15 indicates the presence of clinically significant depressive symptoms.(Burns, Lawlor, & Craig, 2002)

The number of falls each participant sustained while in hospital was collected using three data sources as previous research has demonstrated single sources underestimate the true number of falls (A. M. Hill et al., 2010) Falls meeting the World Health Organization definition ("A fall is an event which results in a person coming to rest inadvertently on the ground or floor or other lower level"(World Health Organisation, 2010)) were included. The sources of falls data were i) computerized incident reports, ii) hand searching of individual patient medical notes, and iii) weekly patient interviews (or at patient discharge if earlier than one week). Falls captured

through any of these three approaches were included.

Health-related quality of life (HRQoL) was measured using the EQ-5D-3L.(Rabin & de Charro, 2001) This scale measures health-related quality of life over five domains: mobility, self care, usual activities, pain and/or discomfort, and anxiety/depression. The participant rates each domain in one of three levels of responses: no problem, some problems / moderate, or severe problems / unable. The Dolan scoring approach(Dolan, 1997) was applied creating a multi-attribute utility score with a possible range from -0.59 to 1.0; where 0 and 1 represent death and perfect health respectively.

Cognitive impairment was measured using the Short-Portable Mental Status Questionnaire. (Pfeiffer, 1975) Higher scores on this the Short-Portable Mental Status Questionnaire indicate better cognitive function.

Self–perceived risk of falling and anxiety about falling were measured with a patient survey as part of baseline and discharge measures. This survey used single items "I think I will fall while in hospital" and "I am worried about falling while in hospital" respectively. A five point Likert scale (strongly agree through to strongly disagree) was used for each item.

Other demographic and outcome variables were collected from patient medical records. These included: Age, gender, highest level of education, history of number of falls in the past 6 months, whether English was spoken as a first language, length of stay in hospital (measured in days), admission diagnosis, admission and discharge destination.

Procedure:

Pre-study training was provided to hospital staff on study wards regarding classification of falls and procedures for recording falls on incident reports using previously developed video materials.(Haines, Cornwell, Fleming, Varghese, & Gray, 2008; A.M. Hill, McPhail, et al., 2009) Patients consenting to participate in the study undertook a baseline assessment of all study measures. Participants were then allocated to one of the two intervention groups or the control group within the falls trial. Discharge measurements for health-related quality of life, depression and cognitive function were undertaken (with assistance from research assistants to administer the questionnaires) within 48 hours of discharge.

Analysis:

The baseline demographics between groups were explored with means, standard deviations and frequencies. Differences between the groups were analysed using t-tests, chi-squared and logistic regression. Associations between factors predictive of admission depressive symptoms and change in depressive symptoms were examined using path analysis(Byrne, 2010) undertaken with Amos 19(Arbuckle, 2006) software package. Both unstandardized and standardized regression coefficients of associations were generated. Unlike multiple regression analysis, path analysis was used to explicitly depict both direct and indirect (mediation) effects between exogenous (predictor) variables and endogenous (outcome) variables. The path analysis included both admission GDS and change in depressive symptoms as endogenous variables.

Variables collected at baseline were used as exogenous variables (including use of admission GDS as an exogenous variable to predict change in GDS as an endogenous variable).

Univariate analyses were also used to build the model initially, with indirect / mediation effects then added to the model. Modification indices were used to assist with the path model development and refinement, as these identify potential associations not already specified in the model. The model was refined by removing any exogenous variables that had no significant direct effect on either of the endogenous variables. The model fit was examined using the Chi Square, Root Mean-Square Error of Approximation (values <0.05 indicate good model fit), and Comparative Fit Index statistics (values >0.95 indicate good fit). Moderation analysis was then undertaken to examine whether group allocation in the randomized controlled trial influenced the associations identified. For this, pairwise parameter comparisons were undertaken across the three groups in the trial so that critical ratios for comparisons between parameters could be calculated. These critical ratios are a z-test for the difference between coefficients where a value >1.96 represents a p-value (two-tailed) <0.05 indicative of a statistically significant moderation. (Fairchild & MacKinnon, 2009)

Results

There were 1206 participants enrolled in the larger RCT. Of these participants, 1168 completed a baseline GDS and 987 participants completed both baseline and discharge GDS. Unplanned discharges or transfers prevented discharge assessment from occurring for some participants which resulted in the lower number of participants completing both baseline and discharge (n=181). Table 1 displays the demographic

data for participants within each group. All groups were similar in all aspects except for the Low vs High intensity group's admission to a rehabilitation setting (p=0.039).

Clinically significant symptoms of depression (GDS cut-off of 6 or above) were present in 53% (n=619 of 1168) of this population at admission. When the magnitude and distribution of depression symptoms was explored for the whole group at admission and discharge, it was determined that the symptoms of depression worsened from admission baseline to discharge for 18%(n=177 of 987) of this sample, but remained unchanged for 55% (n=543 of 987). The change in depressive symptoms was significantly different from zero (p<0.001), indicating that depressive symptoms on average measured using the GDS decreased during the admission. A scatterplot of the admission GDS vs discharge GDS shows change in all groups during admission (Figure 1)

The n, mean (sd) discharge GDS score for the control group was n=314, 6.4 (1.8), for the low intensity group was n=342, 6.8 (1.9), and for the high intensity group was n=338, 6.5 (1.8). Pairwise comparisons of discharge GDS scores adjusted for baseline GDS scores demonstrated that those exposed to the low intensity education program had higher GDS scores at discharge than those in the control group (low intensity vs control n=652, adjusted regression coefficient (95% CI) = 0.24 (0.02, 0.45), p=0.03). Other adjusted pairwise contrasts were not significant (high intensity vs control n=648, adjusted regression coefficient (95% CI) = -0.18 (-0.39,0.03), p=0.10, high intensity vs low intensity n= 674, adjusted regression coefficient (95% CI) = 0.04 (-0.17, 0.25), p=0.73).

Table 2 and Figure 2 present the path analysis that identifies factors predictive of a

higher baseline GDS score, and/or a greater change in GDS score during the admission. The factors that predicted higher levels of depressive symptoms at baseline (r^2=0.09) were, having a history of falls in the past six months, male gender, not having English as a first language, having lower levels of education, being admitted from a residential aged care facility, being recruited for this study from a rehabilitation ward, having a higher self–perceived risk of falling and being worried about falling while in hospital. Lower baseline depressive symptoms and higher levels of worry about the risk of falling were also associated with worsening depressive symptoms over the admission in hospital (r^2=0.26).

The direct effect of worry about the risk of falling in hospital on the change in GDS (the more worried that older adult was about falling predicted worsening depressive symptoms), and the indirect effect of worry about the risk of falling mediated through admission depressive symptoms were opposite in direction. However these effects appeared to cancel each other out when considering the total standardised effect of being worried about falls at admission and change in GDS score (Table 2). The total standardized effects indicated that baseline GDS had the greatest influence on change in depressive symptoms during admission. Two model fit indices (RMSEA =0.019, CFI =0.984) indicated good fit while the third indicated moderate fit (X^2=0.128).

Lastly, the moderator variable analysis examining the effect of group allocation (within the randomized controlled trial) in these results identified that there was a significant difference in path coefficients generated between groups in two out of 45 pairwise comparisons. These were the direct effect of worry about the risk of falling on change in depressive symptoms (high intensity intervention vs. control group pairwise

comparison), and the direct effect of worry about the risk of falling on baseline depressive symptoms (high intensity intervention vs. low intensity intervention group pairwise comparison). The direct effect of worry about the risk of falling illustrated that the high intensity intervention provided in the randomized trial may have changed the nature of the association between the participant's worry about falling and increased depressive symptoms over the admission relative to the control group. In the control group, this standardized direct effect (regression coefficient -0.02) indicated a weak relationship between worry about falls and increasing depression. In the intensive intervention group, this standardized direct effect (regression coefficient -0.18) indicated that higher levels of worry about falls were associated with increasing depressive symptoms. The latter moderation effect appears to represents random inherent variability in the trial data as the assessment of worry about falls and baseline GDS took place prior to randomisation. These two moderation effects were the only significant effects identified from 45 pairwise comparisons examined.

Discussion

This study has identified that a high proportion (53%) of older hospital patients experienced clinically significant depressive symptoms at admission and that these remained at the same level at discharge for the majority, while they worsened for 18% of participants. This finding is important as it points to a considerable magnitude of burden of depressive symptoms amongst hospitalised older adults.

Our study for the first time provides experimental evidence of an association between involvement in a low-intensity falls prevention education program and increasing depressive symptoms during hospitalisation. The low intensity intervention in this trial

consisted of showing a video designed to raise awareness about falls and falls prevention strategies and providing a booklet with similar information without additional follow-up. This low-cost education approach may therefore be harmful, as it has already been demonstrated that it provides no benefit in terms of preventing falls(Haines 2011). It is possible that viewing this material may have made participants more concerned about falls, or thought more about the related processes of ageing and frailty without providing health-professional follow-up to discuss and counsel patients on these issues. However, it must again be stated that this was an opportunistic secondary analysis of data arising from this trial which was not pre-planned, and should therefore be viewed as a hypothesis generating finding rather than a confirmatory one.

A previous systematic review and meta-analysis on risk factors for depression in older adults within the community found that women were at a higher risk of depression than males.(Cole & Dendukuri, 2003) Our study, in contrast, found that men were at higher risk and a much higher prevalence of depressive symptoms at admission. The finding of gender differences is similar to previous research that has highlighted women as being at higher or equivalent risk of falling while in the community, but when in hospital, it is men who are at higher risk.(Haines & Hill, 2011) These findings may indicate that men have greater difficulty with adjusting to being unwell or adapting to the hospital environment.

Those who had a history of falls within the past six months and those who worried about falling were also observed to be at greater risk of experiencing depressive symptoms. It was expected that a recent fall would be a predictor for depressive

symptoms as past research has identified a relationship between depressive symptoms and falls.(Biderman, Cwikel, Fried, & Galinsky, 2002) It was interesting that this relationship was partially mediated by worry about falling in the future indicating that addressing fear of falling may be a potential consideration for managing depressive symptoms in older hospital patients. This therapeutic recommendation may be further justified by previous findings that depressive symptoms in the older population were not associated with an individual's physical and functional ability(Gluyas et al., 2011) despite physical and functional ability being closely associated with falls.(Shumway-Cook et al., 2009)

Lower levels of education have been previously identified within the literature as a risk for depression in older people(Chang-Quan, Zheng-Rong, Yong-Hong, Yi-Zhou, & Qing-Xiu, 2010) corroborating the findings of this research. Little is known about why education levels have been identified as a predictive factor. Cognitive impairment amongst older adults has previously been associated with lower levels of education, however, cognitive function scores taken at baseline using the abbreviated mental test score were not a significant factor in the path model. This result may possibly be due to multi collinarity with the factors admission from a residential aged care facility, previous falls and level of education. Similarly, little is known about why English as a second language is a predictor for depressive symptoms in older adults. Often these patients are excluded from medical trials(Frayne, Burns, Hardt, Rosen, & Moskowitz, 1996) yet appear to be an important sub-group of the population for intervention. One previous study amongst older Korean-American immigrants found that English language proficiency was associated with depressive symptoms,(Park & Bernstein, 2008) while a study of older Iranian-Australian immigrants found anxiety and

depressive symptoms were associated with proficiency in English.(Alizadeh-Khoei, Mathews, & Hossain, 2011) These findings indicate that health services should be particularly cognisant of the risk of depression amongst their patients with limited English language skills.

An important limitation of this research was that data were not collected on whether patients were treated for their depressive symptoms while in hospital. It is possible that some of the associations examined in this study may have been biased by treatments that were provided. This may explain why we were unable to identify any factors predictive of change in depressive symptoms other than admission depressive symptoms (which itself may have been caused by regression to the mean). It is unknown what, if any, impact depressive symptoms had on physical function and other behaviours which may moderate the relationship between depressive symptoms and increased length of stay or falls.

This study has highlighted the potential importance of addressing depressive symptoms amongst older hospital patients, and highlighted patient groups for whom this may be particularly relevant. Further research is required to determine if the depressive symptoms observed during the inpatient period persist following discharge and whether any further burden may be associated with this. Further research is also required to investigate the effectiveness of therapeutic approaches initiated in the inpatient setting, and the potential unintended consequences of providing low intensity falls prevention education interventions.

Conclusion

Clinically important levels of depressive symptoms are common amongst older hospital inpatients and generally persist through to discharge. These symptoms may be exacerbated by participating in a low intensity falls prevention education program. Some factors predictive of depressive symptoms may indicate a relationship to frailty (e.g. history of falls, admission from a residential care facility), though other factors indicate a more complex picture than this.

Conflict of Interest:

TPH is director of Hospital Falls Prevention Solutions Pty Ltd. This company provides consultancy services on the subject of falls prevention in hospitals and provides training in use of the Safe Recovery patient education program which was used in the trial described in this manuscript.

Description of Author roles and funding:

TPH, AMH, SMM, KDH, SGB, TCH, and CEB designed the study. AMH collected the data and TPH was responsible for data analysis. All authors critically interpreted the results; CW and TPH drafted the manuscript and circulated repeatedly among all authors for critical revision. All authors approved the final version.

This research was also funded by a project grant from the National Health and Medical Research Council of Australia. TPH and TCH were supported by a Career Development Fellowship, SMM and AMH were supported by Early Career Fellowships from the National Health and Medical Research Council of Australia.

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Table 1. Demographics of participants within each group

	Control Group	Materials Only Group	Complete Intervention	Control Vs Low Intensity	Control Vs High Intensity	Low Intensity Vs High Intensity
	Mean(SD) or n (%)	Mean(SD) or n (%)	Mean(SD) or n (%)	p	p	p
Total Number of Participants	381 (32%)	424 (36%)	401 ((33%)			
Age	75.25(10.14)	74.73(11.75)	75.25 (10.99)	0.501	1.000	0.510
Gender (male)	203(53%)	223(53%)	216(54%)	0.856	0.870	0.715
Education level				0.995	0.092	0.737
Primary	113 (30%)	120 (28%)	111 (29%)			
Year 10	163 (43%	189 (45%)	171 (44%)			
Year 12	38 (10%)	46 (11%)	47 (12%)			
TAFE/Diploma	47 (12%)	46 (11%)	53 (13%)			
Bachelor degree	14 (4%)	17 (4%)	5 (1%)			
Postgraduate	3 (1%)	6 (1%)	1 (1%)			
English as first language	348 (91%)	376 (89%)	376 (94%)	0.212	0.390	0.697
Faller in previous 6 months	209 (55%)	245 (58%)	212 (53%)	0.383	0.550	0.134
Discharged to residential care	51 (13%)	63 (15%)	45 (11%)	0.600	0.920	0.123
Admitted to a rehabilitation setting	139 (37%)	181 (43%)	143 (36%)	0.073	0.811	0.039
Statement response: *I am worried about falling while in hospital*				0.412	0.619	0.761
Strongly agree	18 (5%)	19 (4%)	26 (6%)			
Agree	99 (26%)	124 (29%)	103 (26%)			
Undecided	13 (3%)	16 (4%)	13 (3%)			
Disagree	169 (44%)	177 (42%)	174 (44%)			
Strongly disagree	72 (19%)	82 (19%)	82 (20%)			
(Missing data)	(9 (2%))	(5 (1%))	(3 (1%))			
Baseline GDS	6.90 (2.02)	7.13 (2.04)	6.69 (2.01)	0.115	0.155	0.002
GDS Change	-0.46 (1.69)	-0.32 (1.59)	-0.19 (1.56)	0.261	0.032	0.282

Table 2. Standarized total effects from path analysis model

	Gender	Faller in previous 6 months	Rehabilitation Admission	English not first language	Worried about falling	Admission from residential aged care facility	Education level	GDS admission score
Faller in previous 6 months	-0.089							
Rehabilitation Admission	-0.006	0.067						
Worried about falling	0.016	-0.182	-0.119					
Admission from residential aged care facility	-0.12							
Education level	0.068							
GDS admission score	0.095	0.12	0.127	-0.075	-0.185	0.07	-0.101	
GDS change score	-0.051	-0.048	-0.057	0.039	0.016	-0.037	0.053	-0.523

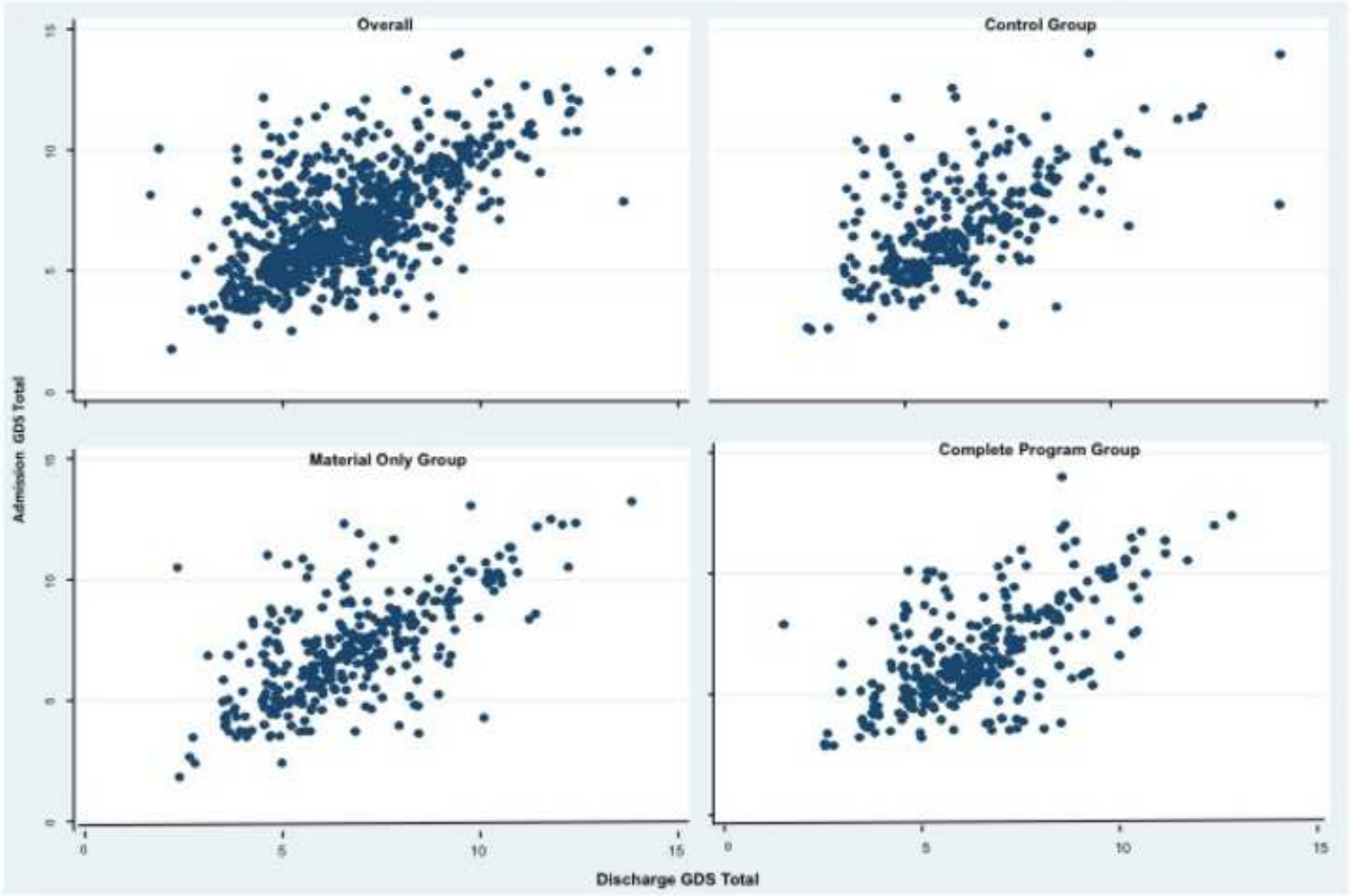
*GDS = Geriatric Depression Scale – Short Form

Figure 1. Scatterplots of overall admission GDS and discharge GDS and for each group.

Figure 2: Path analysis showing standardized regression coefficients, r2 values and model fit statistics

GDS = Geriatric Depression Scale – Short Form
Df = Degrees of freedom
CFI = Comparative fit index
RMSEA = Root mean square residual and standardized root mean square residual

Figure 1


Overall
Control Group
Material Only Group
Complete Program Group
Admission GDS Total
Discharge GDS Total
0
5
10
15